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BULLETIN 761
APRIL 1976

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BIRD DAMAGE TO CONNECTICUT CORN

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Connecticut farmers have been reporting increasing bird damage to seedling corn and to ears of corn on the ripening crop, which apparently is a reflection of increasing agricultural losses to birds in neighboring states (5, 9) and nationwide (6, 7, 8). Seedling damage occurs in the spring when birds pull young plants from the soil to eat the remaining kernel. Damage to ear corn occurs in the late summer and early fall when birds strip back the husks of ears in the "milk" stage of development to feed on the immature kernels (cover photo). To assess the extent of this damage and the economic loss attributable to it, we sampled a farmer's field in Old Lyme in September, 1974, and questioned vegetable growers and dairy farmers by mail in July, 1975. The questionnaire for silage corn is reproduced in Appendix I.

PROCEDURE

A return mailer questionnaire was sent to about 500 persons on the vegetable mailing list, and 900 persons on the dairy mailing list maintained by the Cooperative Extension Service, University of Connecticut. The questionnaire went to farmers and vegetable growers, recent retirees, and persons in businesses related to agriculture.

The progress and severity of damage caused by redwing blackbirds (*Agelaius phoeniceus*) in a 12 acre field of silage corn situated near the Connecticut River in Old Lyme was measured. Eight 20 ft. x 20 ft. plots, each 7 rows deep and containing about 140 plants per plot, were randomly established in the field prior to observations of damage. The number of damaged ears in each plot was recorded on August 30, September 6, and September 18. An ear was recorded as damaged if the husks had been stripped from the ear and kernel damage was evident (cover photo).

RESULTS

Forty-four vegetable growers provided seedling and ear damage information on 12.3% of the 5,100 acres of the 1974 sweet corn crop, and seedling damage information on 10.7% of the estimated 5,500 acres of 1975 sweet corn. One hundred twenty-eight dairy farmers reported ear and seedling damage information about 13.0% of the 1974 silage corn crop, and seedling damage information on 14.5% of the 1975 silage corn crop, each estimated at 47,000 acres by the Statistical Reporting Service, U.S. Department of Agriculture. Seven of the responding vegetable growers (16%) and 35 of the responding dairy farmers (27%) reported no bird damage. Therefore, many fields with bird damage and others without damage were included in the survey.

Geographic Distribution of Sweet Corn Damage

During 1974, bird damage was reported on 284 of the 628 acres of sweet corn grown by respondents. Of the 284 acres of reported damage 72%, or 205

acres, was incurred as ear damage and 28%, or 79 acres, was incurred as seedling damage (Fig. 1). Compared with this statewide pattern of crop damage, Hartford, New Haven, Windham, and Middlesex

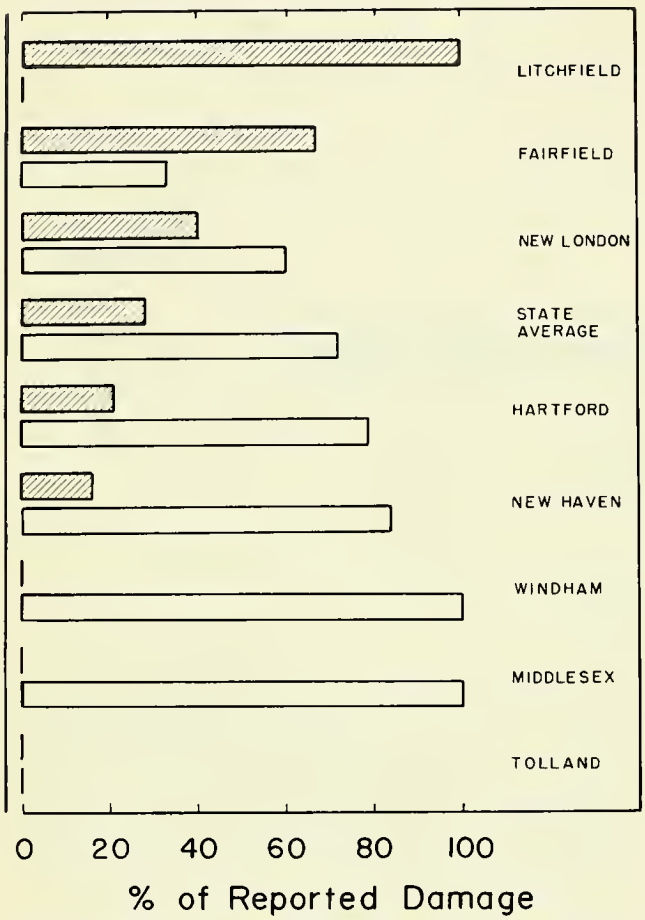

Figure 1 Proportion of reported bird damage on sweet corn sustained as seedling (▨) and ear (□) damage, by state and county, 1974.

counties sustained relatively greater ear damage and lesser seedling damage. Crops in New London, Fairfield, and Litchfield counties sustained relatively lesser ear damage and greater seedling damage. No damage to sweet corn was reported in Tolland County.

Seedling damage was reported on about 1.5% and ear damage on about 4% of the 5,100 acres of sweet corn planted in 1974. However, the proportion of planted sweet corn acreage suffering bird damage varied among the eight counties (Fig. 2, a & b). There was a tendency for seedling damage to increase with planted acreage. Fairfield County, with 4.7% seedling damage, or triple the state average on a relatively modest 475 acres of planted corn, appeared to deviate from this trend (Fig. 2a).

Ear damage to sweet corn also increased with planted acreage, with negligible losses reported for Tolland and Litchfield counties and 8% ear damage reported in Hartford county. Ear damage to sweet corn in Hartford County was double the statewide average (Fig. 2b). Clearly, ear and seedling damage to sweet corn was generally greatest in those counties with the largest acreages planted.

Geographic Distribution of Silage Corn Damage

Bird damage was reported on 1,356 of the 6,093 acres of silage corn grown by respondents in 1974. Of the total, 65%, or 880 acres, was ear damage and 35%, or 476 acres, was seedling damage (Fig. 3). Farmers in New London, Hartford, New Haven, Tolland, and Middlesex counties reported relatively greater ear damage and lesser seedling damage. Litchfield, Windham, and Fairfield county farmers reported relatively lesser ear damage and greater seedling damage than the statewide pattern.

Seedling damage was reported on about 1% and ear damage on 1.9% of the 47,000 acres of silage corn planted in 1974. Like the damage patterns to sweet corn, the proportion of planted silage corn suffering bird damage varied strikingly among the eight counties (Fig. 4, a & b). Seedling damage to silage corn ranged from 0.1% of the planted acreage in Tolland county to 2.4% of the planted acreage, or more than twice the state average, in Windham county. Ear damage to silage corn ranged from 0.2% of the planted acreage in Fairfield county to 7.8% of the planted acreage, or quadruple the state average, in New Haven county.

Damage reported on silage corn was more randomly distributed by county, and lacked the correlation of sweet corn with planted acreage (cf. Figs. 2 and 4). This is best exemplified by ear damage to silage corn in New Haven and Hartford counties, which is far greater than would be expected on the relatively modest acreage planted.

Economic Loss to Seedling Corn

Seedling damage to sweet corn was reported on 12.6% of the acreage grown by respondents in 1974

Table 1 Bird damage to seedling corn as reported by respondents.

	Planted		Damage		Replanted		Economic Loss			
	Acres		Acres		Acres		(dollars/Acre)		(% Market Value)	
	1974	1975	1974	1975	1974	1975	1974	1975	1974	1975
Sweet Corn	628	586	79	72	33	32	131	177	26	35
Silage Corn	6093	6807	476	842	135	270	27	27	9	9

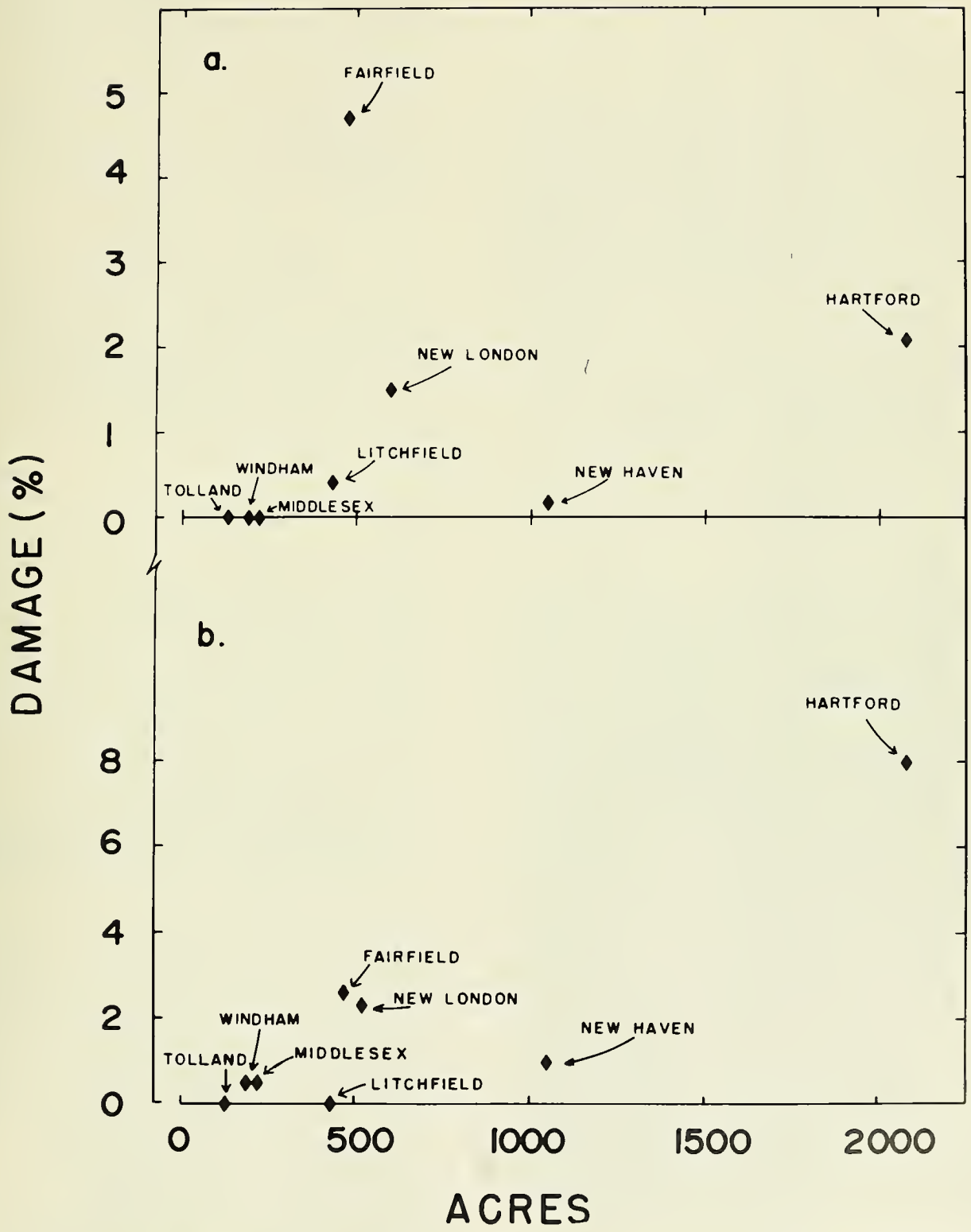

Figure 2 (a) Reported seedling damage to sweet corn as percent of planted acreage, by county, 1974. (b) Reported ear damage to sweet corn as percent of planted acreage, by county, 1974.

Table 2 Bird damage in 1974 to ears of ripening corn as reported by respondents.

	Planted	Damaged	Economic Loss	
	acres	acres	(dollars/acre)	(% market value)
Sweet Corn	628	205	174	34
Silage Corn	6093	880	30	10

and 12.3% of this acreage in 1975 (Table 1). About 5.3% of the acreage grown by respondents was sufficiently damaged to require replanting in 1974. In 1975, 5.5% of this acreage was replanted. The economic loss attributed to bird damage to seedlings was \$131/acre in 1974 and \$177/acre in 1975. With the 1973 sweet corn crop valued at \$511/acre, this economic loss represented 26% of the market value of the damaged crop in 1974, and 35% of the value of the damaged crop in 1975.

Seedling damage to silage corn was reported on 7.8% of the acreage grown by respondents in 1974 and 12.4% of this acreage in 1975 (Table 1). About 2.2% of the acreage grown by respondents required replanting in 1974, while 3.9% of this acreage was replanted in 1975. The economic loss attributed by the farmers to seedling damage by birds was \$27/acre in 1974 and 1975. With a 15 ton/acre crop of silage corn valued at \$300/acre, seedling damage represented 9% of the value of the crop in both years.

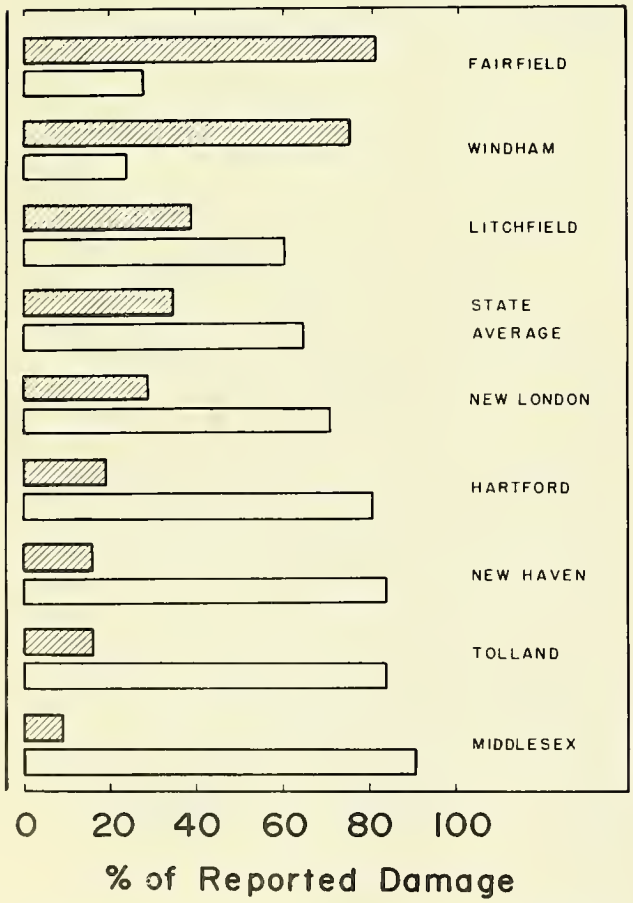

Figure 3 Proportion of reported bird damage on silage corn sustained as seedling (▨) and ear (□) damage, by state and county, 1974.

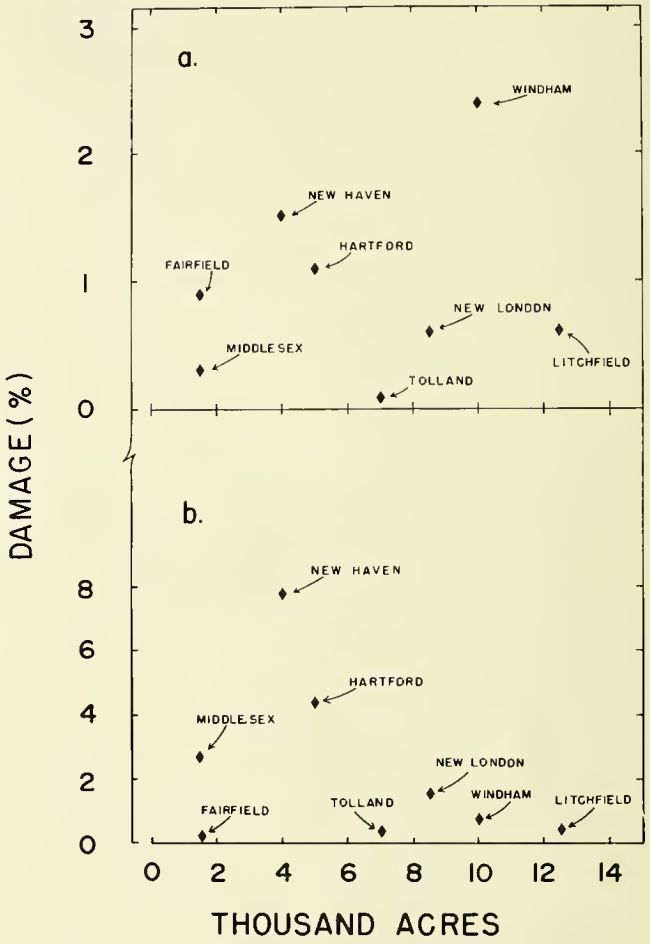

Figure 4 (a) Reported seedling damage to silage corn as percent of planted acreage, by county, 1974. (b) Reported ear damage to silage corn as percent of planted acreage, by county, 1974.

Economic Loss to Ear Corn

Bird damage to ears of sweet corn was reported on 33% of the acreage grown by respondents in 1974 (Table 2). The economic loss attributed by the farmers to damaged ears was \$174/acre, or 34% of the market value of the crop at 1973 prices. Damage to ears of silage corn was reported on 14% of the acreage grown by respondents in 1974. The loss attributed by the farmers to damaged ears was \$30/acre, or 10% of the market value of the crop.

Bird Species Implicated in Damage

Farmers ascribed about 26% of the sweet corn seedling damage to crows (*Corvus brachyrhynchos*), 30% to redwing blackbirds, 21% to starlings (*Sturnus vulgaris*), 22% to grackles (*Quiscalus quiscula*), and

the remaining 3% to other bird species. Of the seedling damage to silage corn, 28% was ascribed to crows, 24% to the redwing blackbird, 20% to starlings, 19% to grackles, and 9% to other bird species. Damage by mammals was excluded from this survey.

Farmers ascribed 7% of the damage to ears of sweet corn to crows, 27% to redwing blackbirds, 30% to starlings, 30% to grackles, and 7% to other species. About 12% of the ear damage to silage corn was ascribed to crows, 21% to redwing blackbirds, 26% to starlings, 34% to grackles, and 7% to other species. Other species reportedly damaging seedling and ear corn were mourning doves, geese, bluejays, and pigeons.

Silage Corn Damage: Case Histories

Results from a damage survey on a crop of silage corn in Old Lyme substantiated the severity of the bird damage on corn as reported by vegetable growers and dairymen. In addition, the deterioration of the crop following bird damage was revealed.

The following progression of damage was observed:

	% Damaged Ears	
Date	*Range*	*Mean*
30 August	2-23	10
6 September	19-43	34
18 September	34-76	56

The progression of damage mirrors the pattern of maturation of the corn, with the early milk stage being the most desirable to birds. The birds stripped the husks from the tips of ears and usually fed on the distal 15 to 40% of the cob. On each date of observation, ears bearing grain either less or more mature largely escaped predation. After the ear was damaged, the birds usually preferred to sample an undamaged ear rather than renew feeding on a previously sampled ear. This pattern of feeding may be attributable to the difficulty of removing husks nearer the base of the ear, to the increased maturity of kernels near the base of the ear, or to the onset of microbial fermentation in the damaged kernels 2 to 3 days after the initial feeding.

After the feeding damage, exudation from the initial microbial infection at the distal end of the ear drained down to the base and initiated a secondary infection (Fig. 5). The odor of fermentation pervaded the entire cornfield during the decomposition of the grain, which was often sufficient to include all the grain on the cob. On September 18, we calculated from measurements of plot damage that 56% of the ears in the field had sustained damage. Allowing for all stages of decomposition, we conservatively estimated that 50% of the grain on the damaged ears remained, or that about 28% of the grain in the entire field was destroyed by September 18. Although grain is half the dry matter in the plant, it is more than half of its total nutritional value. Consequently, our results suggest that the feeding value of the crop as silage was reduced 18% by bird damage. With silage corn valued at $300/acre, this damage is the equivalent of $54/acre, or double the statewide loss of $27/acre for silage corn in the survey.

Another evaluation of bird damage was conducted on six randomly sampled ears from the center row of three row x 25 ft. plots of 30 early maturing varieties of silage corn in the 1975 yield trials at the University of Connecticut. This revealed damage ranging from 0 to 27% grain loss, with an average of 10%. The most severely damaged variety sustained damage similar to that of the field in Old Lyme, while the value of the average damage to the 30 varieties was similar to the statewide loss of $27/acre in the survey.

DISCUSSION

Recent studies of bird damage to corn have emphasized late summer damage to grain (1, 3, 7, 8, 9), and springtime damage to young seedlings (6). Because Connecticut farmers encounter bird damage early and late in the growing season, we sought information on the extent and economic impact to seedling and ear corn.

The four types of damage surveyed occur at different intervals during the growing season because of

Figure 5 Ears of silage corn showing 30 to 50% grain destruction by birds. On these ears, a secondary microbial infection is destroying the grain at the base of the ear.

variation in crop planting dates and maturities. Seedling damage to sweet corn occurs in late April and early May, while damage to seedlings of later-planted silage corn occurs from mid-May to early June. Sweet corn for fresh market normally matures from mid-July through late August, while silage corn usually matures from late August through September. Consequently, damage to the ears of sweet corn precedes that to silage corn by nearly a month.

Granivorous birds selectively feed on corn grain at intervals during the year when other sources of nourishment such as insects, alternate crops, or weed seeds are in short supply (4, 10). In our study, crows inflicted about 27% of the total bird damage to seedling corn, about triple that inflicted to ears on ripening crops. We have never observed crows feeding on ears of corn plants in Connecticut fields, so perhaps the small amount of ear damage ascribed to crows was due to misidentification by a respondent. The balance of the seedling damage, and most of that to the ripening crop, was approximately equally ascribed to redwing blackbirds, grackles, and starlings.

That selective feeding on sweet corn occurs is exemplified in Fig. 2, where the extent of damage by county increases with area of sweet corn grown. The results suggest that seedling and ear sweet corn are prime food sources of granivorous birds in Connecticut's urban environment, and that the birds congregate and feed on sweet corn in counties with the largest acreages or the most extensive food supply. Our results of sweet corn damage in early spring and mid-summer are consistent with the hypothesis of non-random and persistent feeding patterns within a growing season (2).

Unlike seedling damage to sweet corn, the proportion of seedling damage to silage corn was apparently unrelated to the amount of planted acreage (Fig. 4a). Perhaps the nearly 10-fold greater availability of seedling silage corn compared with sweet corn, and the likely availability of other foods such as insects, reduced the consistent dependence of birds on seedlings of silage corn. However, the total seedling damage to silage corn was greater in the counties with larger acreages.

During the seedling damage period, and the ear damage period for sweet corn from late April through mid-August, migratory species like redwing blackbirds are likely engaged in nesting, incubation, and territorial defense, congregating in upland and marsh roosts at night and foraging within about 20 miles of the nest in daytime (10). In contrast, damage to ears of silage corn in September occurs when the migratory granivores are flocking prior to autumn migration. Greatest damage might be anticipated in corn growing areas within commuting distance of major roosting areas in marshes along the shoreline or along the Connecticut River. Indeed, the damage in New Haven, Middlesex, and Hartford counties apparently conforms to this expectation (Fig. 4b). Thus the rather minor damage in the two major silage corn growing counties, Litchfield and Windham, is logically explained by their remoteness from rivers and the shoreline.

Some previous analyses of bird damage have restricted impact assessment to the quantity or value of the grain consumed (1, 3, 8). That the impact of bird damage to corn in Connecticut's urban environment is greater than that directly attributable to grain loss (e.g. 7, 8, 9) is easily illustrated. The judgments of economic loss caused by bird damage to seedling corn (Table 1) are mediated by grower evaluations of the cost of crop replacement, which includes seed, fertilizer, insecticide, fuel, and machinery operation.

In many instances damaged fields are not replanted, so the judgments of damage reflect the reduction in stand and in marketable yield sustained by the farmer. An additional factor leading to larger per acre damage estimates for sweet than silage corn relates to timeliness of marketing. Replanting of sweet corn results in the crop reaching the market later in the season when the price is poorer, and the grower is cognizant of this factor when judging his economic loss (Table 1). Replanting of silage corn may lower yield because of a shorter growing season and the risk of frost, but the unit value of the product is not materially changed.

The judgments of economic loss caused by bird damage to nearly mature crops are modified by the knowledge of the utility of the damaged product (Table 2). Damaged ears of sweet corn are unmarketable as human food, and the vegetable growers must either absorb the loss, or sell the damaged portion to dairymen for silage. Because insecticide residues, normally absent on the husked ears consumed by humans, may be on the foliage of sweet corn, often its use as feed for dairy cattle is precluded.

Ear damage to silage corn does not prevent the harvesting of the crop for cattle feed, although the reduced grain content surely lowers its feeding value. We have also reported that the fermentation that ensues after bird damage of ears may also destroy a substantial portion of grain, and greatly reduce the feeding value of the silage (Fig. 5). To rectify this deficiency, the dairymen must purchase additional grain, or suffer decreased milk production. Bird damage may also aggravate insect damage since adult beetles of the northern corn rootworm are more prevalent in ears damaged by birds.

SUMMARY

Respondents in a survey reported that 284 of 628 acres of sweet corn grown in 1974 were damaged by birds. This damage was valued at about $46,000. Ap-

proximately 205 acres of ear damage valued at $174/acre and 79 acres of seedling damage valued at $131/acre were reported. 72 acres of seedling damage valued at $177/acre were reported on 586 acres of sweet corn grown in 1975. Sweet corn damage was most severe in counties with the largest acreages.

Respondents in a survey reported that 1,356 of 6,013 acres of silage corn grown in 1974 were damaged by birds. This damage was valued at about $39,000 and was comprised of 880 acres of ear damage valued at $30/acre and 476 acres of seedling damage valued at $27/acre. 842 acres of seedling damage valued at $27/acre were reported on 6,807 acres of silage corn grow in 1975. Bird damage to ears of silage corn results in grain loss, but contamination by microorganisms subsequently causes additional crop damage. The extent and severity of damage to silage corn reported in the survey was substantiated by samplings of a farmer's field in 1974 and during variety trials in 1975.

Redwing blackbirds, starlings, grackles, and crows were the species most frequently implicated, with crows being more troublesome on seedling than on ear corn.

ACKNOWLEDGEMENTS

We gratefully acknowledge the cooperation of R. A. Ashley, Extension Vegetable Specialist, K. R. Goff, J. F. Nye, and P. T. Roberts, Area Dairy Agents, Cooperative Extension Service, University of Connecticut in conducting the survey, and collaboration with Richard Moore, The Connecticut Agricultural Experiment Station, in some of the field sampling. J. L. Guarino, Section of Bird Damage Control, Denver Wildlife Research Center, U.S. Department of the Interior, critically reviewed the manuscript, and we are grateful for his suggestions.

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APPENDIX I

BIRD DAMAGE SURVEY

Connecticut farmers are reporting increasing bird damage to seedling and standing corn. To assess the extent and cost of this damage the Cooperative Extension Service, Storrs, and the Connecticut Agricultural Experiment Station, New Haven, request that you complete and return this survey form.

If we receive enough information we will be able to better understand bird damage in Connecticut. Put down your name and address and we will send you a summary of this study.

Please comment on any observed patterns of bird damage. Are large (more than 10 acres) or small fields more severely damaged? Are fields located near housing developments more severely or less severely damaged? If no pattern of bird damage to fields is observed, please mention this.

The questionnaire appears on a pre-addressed mailer card which requires no postage. Please fill it out, separate on the perforated line, and send it back to us before July 31.

BIRD DAMAGE SURVEY

	1974	1975
Total Acres Field Corn You Planted		
Seedling Damage – Acres		
Acres you had to replant		
Your estimated dollar cost of damage		
Ear Damage on Standing Crop – Acres		
Estimated dollar value of damage		

Can you estimate (approximately) which birds did the damage?

(Example: Crows 90%, Grackles 10%)

	Seedling Corn 1974	Seedling Corn 1975	Standing Crop 1974
Crows			
Redwing Blackbirds			
Starlings			
Grackles			
Other			

Comments _____

_____

_____

Town in which fields are located _____

Your Name _____

Address _____

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